

Appl. No.: 09/718,528

Amdt. dated: December 22, 2003

Reply to Office action of: September 24, 2003

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

- 1 (original). A method for detecting text in a mixed-content image, said method comprising:
- (a) identifying an edge associated with a high-contrast intensity change;
 - (b) identifying an intensity gradient direction for said edge;
 - (c) identifying a stroke axis;
 - (d) measuring a spatial relationship between said axis and said edge; and
 - (e) identifying said edge as a text edge when said spatial relationship conforms to specified criteria.

2 (original). The method of claim 1 wherein said identifying an edge and said identifying an intensity gradient direction comprises a first-derivative edge detection method.

3 (original). The method of claim 1 wherein said identifying an edge and said identifying an intensity gradient direction comprises a Sobel edge detection method.

4 (original). The method of claim 1 wherein said measuring a spatial relationship comprises a transverse directional search.

5 (original). The method of claim 1 wherein said measuring a spatial relationship comprises measuring the proximity of an edge to an axis in a direction substantially transverse to a stroke.

Appl. No.: 09/718,528

Amdt. dated: December 22, 2003

Reply to Office action of: September 24, 2003

6 (original). The method of claim 1 wherein said measuring a spatial relationship comprises measuring the proximity of an edge to an axis in a direction substantially perpendicular to said axis.

7 (original). The method of claim 1 wherein said measuring a spatial relationship comprises measuring the proximity of an edge to an axis in a direction parallel with said intensity gradient direction.

8 (currently amended) . The method of claim 1 wherein said identifying a stroke axis comprises the acts of: analyzing successive pixels to identify a coincident curvature position wherein a substantial curvature of an intensity map occurs at the same location as a minimal curvature of said intensity map in another direction;

9 (original). The method of claim 1 wherein said measuring a spatial relationship comprises the acts of:

- (a) beginning at a subject pixel that has been identified as an edge and progressively analyzing adjacent pixels in a direction parallel with the intensity gradient of the subject pixel; and
- (b) analyzing each successive pixel to determine whether said successive pixel has been identified as an axis pixel.

10 (original). A method for detecting text in a mixed-content image comprising:

- (a) processing said image to identify edge components associated with significant intensity changes;
- (b) processing said image to identify an intensity gradient direction for each of said edge components;
- (c) processing said image to identify axes;
- (d) measuring the proximity of said axes to said edge component; and

Appl. No.: 09/718,528

Amdt. dated: December 22, 2003

Reply to Office action of: September 24, 2003

- (e) identifying said edge component as a text edge component when said proximity conforms to specified proximity criteria.

11(currently amended). The method of claim 5-10 wherein said processing said image to identify edge components and said processing said image to identify an intensity gradient direction comprise a first-derivative edge detection method.

12(currently amended). The method of claim 5-10 wherein said processing said image to identify axes comprises an analysis of intensity map curvature around a given location.

13 (currently amended). The method of claim 5-10 wherein said processing said image to identify axes comprises analyzing successive pixels to identify a coincident curvature position wherein a maximum curvature of an intensity map, said maximum curvature being greater than a threshold value, occurs at the same location as a minimal curvature of said intensity map, said minimal curvature being lower than a specified value and being in a direction approximately perpendicular to said maximum curvature;

14(original). A method of identifying a text stroke in a mixed-content image based on a partial character sample, said method comprising:

- (a) identifying edge image components of an edge associated with a high-contrast intensity change;
- (b) identifying an intensity gradient direction for said edge image components;
- (c) identifying an axis proximate to said edge image components; and
- (d) measuring the proximity of said axis to said edge image components in a direction parallel to said intensity gradient direction.

15 (original). A method for detecting text in a mixed-content image comprising:

Appl. No.: 09/718,528

Amdt. dated: December 22, 2003

Reply to Office action of: September 24, 2003

- (a) processing said image to identify edge pixels associated with significant intensity changes;
- (b) processing said image to identify an intensity gradient direction for each of said edge pixels;
- (c) processing said image to identify axis pixels having coincident curvature wherein a maximum curvature of an intensity map, centered a subject pixel occurs at the same location as a minimum curvature of said intensity map and wherein said maximum curvature occurs in a direction approximately perpendicular to said minimum curvature;
- (d) when said coincident curvature position exists, identifying said subject pixel as an axis pixel;
- (e) measuring the proximity of said axis pixel to said edge pixel; and
- (f) identifying said edge pixel as a text edge pixel when said proximity conforms to specified proximity criteria.

16 (original). An apparatus for detecting text in a mixed-content image, said apparatus comprising:

- (a) an edge detector for detecting image edge components at an edge associated with a high-contrast intensity change in an image;
- (b) a gradient direction detector for detecting an intensity gradient direction for at least some of said image edge components;
- (c) an intensity curvature analyzer for determining the presence of geometric intensity curvature features; and
- (d) a proximity measurer for measuring the proximity of at least one of said features to at least one of said edge components.

Appl. No.: 09/718,528

Amdt. dated: December 22, 2003

Reply to Office action of: September 24, 2003

17(original). The apparatus of claim 16 further comprising an identifier for identifying said edge component as a text edge component when said proximity conforms to specified proximity criteria.

18(original). A computer readable medium for detecting text in a mixed-content image, said method comprising the acts of:

- (a) identifying an image edge component of an edge associated with a high-contrast intensity change in an image;
- (b) identifying an intensity gradient direction for said edge component;
- (c) identifying a geometric intensity curvature feature;
- (d) measuring the proximity of said feature to said edge; and
- (f) identifying said edge component as a text edge component when said proximity conforms to specific proximity criteria.

19(original). The medium of claim 18 wherein said components are pixels.

20(original). The medium of claim 18 wherein said identifying a geometric intensity curvature feature comprises an analysis of image components until the change in curvature of the intensity curve between two successive image components in a direction substantially parallel to the intensity gradient direction reaches a maximum absolute value at the same position that the change in curvature of the intensity curve in a direction substantially perpendicular to the intensity gradient direction is near zero.

Appl. No.: 09/718,528

Amdt. dated: December 22, 2003

Reply to Office action of: September 24, 2003

21. A computer data signal embodied in an electronic transmission, said signal having the function of detecting text in a mixed-content image, said signal comprising instructions for:
- (a) identifying an image edge component of an edge associated with a high-contrast intensity change in an image;
 - (b) identifying an intensity gradient direction for said edge component;
 - (c) identifying an axis;
 - (d) measuring the spatial relationship between said axis and said edge; and
 - (e) identifying said edge component as a text edge component when said proximity conforms to specific proximity criteria.